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***Operations and Services***
***Hydrologic Services, NWSPD 10-9***
***River Forecast Center Operations, NWSI 10-911***
***Weather Forecast Office Hydrologic Operations, NWSI 10-921***

# *RESPONSIBILITIES RELATED TO DAM FAILURES*

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Signed 12/05/02
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Table of Contents: Page



1. Purpose: The purpose of this Supplement is to establish Western Region policy regarding field office responsibilities and activities related to dam failures.

2. Format and Procedures.

2.1 WFO Responsibilities: In the event of a known or potential dam failure which will or could cause high flows and pose a risk to life and property, weather forecast offices (WFOs) are responsible for issuing watches and warnings for points in their county warning area (CWA) which are downstream of the dam.

Upon notification of a dam failure or potential dam failure, a WFO will follow the following steps:

a. **Confirm Report**: If a report of a dam failure, or potential dam failure was received by someone other than a reliable source such as the owner of the dam, emergency services personnel, local law enforcement officials, etc.., or the report seems suspicious, the WFO should attempt to confirm the report. If the report cannot be verified, the WFO should use best judgement on selecting the appropriate course of action. As much information as possible needs to be obtained about the failure or potential failure. A form similar to the ones in attachment 2 should be used to log information.

b. **Issue Product:**

(1) If the dam has already failed or failure is expected, the WFO will issue a flash flood warning (FFW) for the flood plain downstream of the dam as quickly as possible. To save time, the person who receives the phone call may delegate the issuance of the FFW to another member of the operational staff while he/she continues to obtain as much information as possible from the caller. The warning should initially be qualitative, emphasizing the life-threatening nature of the situation and urging people

in the affected area to take immediate life-saving actions. Information received from reliable sources should be included in the warning along with specific identification of the source(s).

(2) If the dam has not yet failed but the owner or operator has expressed concern for the safety of the dam and a failure or large release is possible, the WFO should issue a Flash Flood Watch (FFA) for the flood plain downstream of the dam. The watch should emphasize the potential danger, so people in the affected area can begin to take appropriate action.

c. **Contacts**: After issuance of the initial product, the following persons should be contacted in this order:

(1) Dam Owner (if not already contacted) - obtain as much information as possible concerning the dam failure or problem.

(2) River Forecast Center (RFC) - to brief on the situation, request support and pass along information about the dam.

(3) Adjacent WFO if the failure is likely to affect their CWA as well.

(4) Meteorologist in Charge (MIC) and Service Hydrologist/Hydro Focal Point (if they are not on station at time of notification) - to brief on the situation.

(5) State Liaison Office (SLO) MIC - to brief on the situation so that he/she may provide support to the State Emergency Services Offices if requested. The SLO will also notify their Senior Service Hydrologist of the situation.

(6) WRH/HCSD - to brief on the situation.

d. **Issue Follow-up Statements/Watches/Warnings:** Follow-up watches, warnings or statements will be issued to include more quantitative information as it becomes available (time and magnitude of the crest, area expected to be inundated, etc.). The WFO should coordinate follow-up statements/watches/warnings with the RFC. Coordination may also be necessary with the dam owner and/or local emergency services.

When the impact downstream of the dam is not known, the WFO can issue a warning for the area from the dam to a given location and a watch downstream of that point. When river forecast guidance is available from the RFC for locations impacted by a dam failure, and sudden flooding is not expected within 6 hours, the WFO can issue flood warnings (FLW) and statements (FLS) to handle the remainder of the event. In this case, a statement should be issued stating that future information on this event will be available under the FLW and FLS product headers.

Quantitative data should be incorporated into the watches/warnings/statements whenever possible. If such data is not yet available from the RFC, WFOs should utilize either available emergency action plans or the "Dam-Break Rules of Thumb" (see Attachment 1) to provide some quantitative information. Information from the Dam Catalog may also be used. In most cases, inclusion of such data will be limited to the follow-up messages issued after the initial warning. Whenever possible, the WFO should coordinate forecast data with the RFC prior to releasing it to the public. Coordination with dam owners and/or local emergency services may also be necessary.

The WFO should evaluate staffing and augment if necessary. Factors to consider are the need to obtain and verify data pertaining to the situation, coordinate with the RFC, and handle media and other calls. If the event involves a large dam or one which could affect a major metropolitan area, additional help will likely be needed.

2.2 RFC Responsibilities: Western Region RFCs will provide the highest level of support to the WFOs in their area for all cases of dam failure or potential dam failures. This support should include the validation of the information in the Dam Catalog or another method of providing preliminary quantitative information quickly. More sophisticated procedures (i.e. simplified or full versions of DamBreak) should be run at the RFCs as soon as possible and data availability allows. RFC support will continue as long as flooding persists. If the flood wave reaches an official river forecast point, the RFC will then issue River Forecast Guidance (RVF) as is done for other flood events.

2.3 Dam Break Forecasts: Western Region WFOs are not expected to use modeling techniques to obtain quantitative information on dam failures. This responsibility falls to the RFCs. WFOs are expected to use other means, such as "Rules of Thumb" and Emergency Action Plans to obtain preliminary quantitative information on a flood wave resulting from a dam failure. WFOs are expected to take the lead in collecting information needed by the RFCs to conduct dam failure modeling.

2.4 Readiness: Western Region WFOs should be prepared to take all necessary actions should a dam fail. This includes: staff familiarization with the major dams located in the CWA, readily available up-to-date procedure documentation, preformatted watches/warnings, dam-failure logs (see attachment 2). The WFOs should also maintain close liaison with the local emergency services personnel regarding actions to be taken during a dam failure. WFOs also need to ensure that their office and 24-hour telephone number is listed in the notification list of all Dam Emergency Action Plans within their CWA, and that they are listed as high as possible on that list. To justify the NWS position high on the call list, WFO staff should explain the benefit of the EAS in alerting downstream communities. Copies of all emergency action plans available in the CWA should be kept on station. Dam-failure drills should be conducted annually.

Western Region RFCs should be prepared to take all necessary actions should a dam fail or threaten to fail. This includes running DamBreak models, providing expert assistance and perform pre-event dam-break analyses for dams that pose an imminent threat to the safety of the residents downstream from the dam. Such a determination should be a coordinated effort among

the RFC, WFO, and when possible, the dam owner and/or other responsible state and federal agencies.

# APPENDIX 1

## Dam Break Rules of Thumb

The magnitude of flooding that occurs from a dam failure is related to several factors. The most important are:

- the volume of water impounded by the dam
- the starting water surface elevation or 'head'
- size of the breach in the dam
- distance to the nearest downstream town
- the time it takes for a dam to fail

These guidelines are intended only to give general and quick guidance in the event of a dam failure. It is not implied that they represent exact solutions applicable to all situations.

The following three sections provide information on estimating the characteristics of a flood wave resulting from a dam failure. The first section discusses the height of the initial flood wave. The second section provides a means of estimating the speed at which the flood wave moves downstream. The third section describes a means of estimating the attenuation of the flood wave height as it moves downstream. The essentials in each section are underlined.

1. Right at the dam, the maximum height of the flood wave will be no greater than about half of the starting height of the water behind the dam before structural failure began. This assumes a rapid structural failure. If the failure takes a number of hours, the height will be less.

   Ex. A dam 50 ft high has water to a height of 40 feet in back of it. The initial flood wave at the dam site in the event of a rapid failure will be no higher than 20 feet. The longer the structural failure takes, the lower the initial flood wave height will be.

2. A flood wave moving downstream is a complex phenomena which is affected by many channel characteristics, such as slope, cross-sectional area, and channel roughness. The average downstream speed of a flood wave is:

   3-4 mph normal/shallow slopes
   5-7 mph steeper slopes/foothills
   8-10 mph steep slopes/mountains

   The flood wave will attenuate in height and speed very quickly as it spreads across the flood plain.

   Ex. Teton Dam in Idaho, 262 ft high, failed structurally very quickly, in about one hour. The flood wave moved as follows:

   5 miles in about ½ hour

10 miles in about 1 hour
20 miles in about 9 hours
50 miles in about 30 hours

Ex. Buffalo Creek Dam in West Virginia, 45 ft high, also failed very quickly, and the downstream flood wave moved as follows:

5 miles in about ½ hour
10 miles in about 1½ hours
15 miles in about 3 hours

3. A reasonable assumption for the attenuation of flood wave height is that the flood wave will be reduced by about half for each ten miles of travel downstream.

Ex. A dam with 80 ft of water in back of it collapses very quickly. Approximate wave heights downstream are as follows:

At the dam site - 40 feet
10 miles downstream - 20 feet
20 miles downstream - 10 feet
30 miles downstream - 5 feet
40 miles downstream - 2 feet
50 miles downstream - 1 foot

# APPENDIX 2

**Information - - Dam Failure/Potential Dam Failure - - Report Log**

1. Date/time report received_____

2. Name of person reporting failure_____
   Phone number of person reporting failure_____
   Address (if available)_____
   Name of original source/witness of report_____

3. Is person reporting failure affiliated with local, county, state, or Federal Government?
   Yes/No If yes, what agency or department?_____

4. Name of dam_____
   County in which located_____
   Name of river or stream_____
   Name of nearest downstream town_____
   Name of dam owner (if known)_____
   Estimated time of failure_____
   Estimated breach width (if known)_____
   Water surface elevation (if known)_____
   Dam height (if known)_____
   Type of Dam (earthen, concrete, etc.)_____

5. Has any other government agency/department been notified by the person making the report? Yes/No If yes, what agency/department? _____

6. If dam has not failed but may, get description of current dam condition (cracked, over-flowing top/around sides, washing sides, sand boils, etc.)
   _____
   _____
   _____
   _____

7. Obtain any additional data available
   _____
   _____
   _____

8. Notification of appropriate RFC and WRH/HCSD_____

VERIFICATION -- Required if person reporting failure is other than government agency.
Dam failure/potential verified with _____agency/department.
Name of person in agency/department _____
ACTION --- Determine whether:
- The dam has failed or failure is imminent.
- Dam has not failed but will probably fail within 12 hours.
- Dam has not failed but will probably fail and the failure is forecast to be greater than 12 hours after you were informed of the possibility.

Name of person completing this report_____

# DAM INCIDENT REPORT LOG

**CHECK ONE:** ☐ ACTUAL FAILURE ☐ POTENTIAL FAILURE ☐ INFORMATION REPORT ☐ DRILL

DATE/TIME CALL RECEIVED: _____ CALL RECEIVED BY: _____

**CALLER INFORMATION**

| Name | Agency | Telephone Number |
|---|---|---|
| | | |

**DAM INFORMATION**

| Dam Name | River/Stream | County |
|---|---|---|
| | | |

| Lake Elevation (Feet) | Current Storage (Acre-Feet) | Max Storage (Acre-Feet) |
|---|---|---|
| | | |

**SITUATION DESCRIPTION:** (Ask Questions! Talk to the caller. From this description can you determine what product to issue?)

## STOP! THINK: IS THIS DAM IN OUR CWA?

**IF DAM IS OUTSIDE OUR CWA:**

| *Which other office notified:* | *Name of person you notified:* | *Time of this notification:* |
|---|---|---|
| | | |

☐ I notified _____ at the RFC
Yes, write their name here.

**IF DAM IS INSIDE OUR CWA:**

*Additional information to collect from Dam Catalog:*

| *Dam Type (earth, rock, etc.)* | *Nearest downstream town* | *Travel time to town (Minutes)* |
|---|---|---|
| | | |

*Action taken:*

| *Product Issued (Please attach)* | *Time Issued* | ☐ *Watch/Warning Log completed and attached* |
|---|---|---|
| | | |

☐ I notified the Service Hydrologist

| *WRH notified (if actual failure):* | *Name of person you notified:* | *Time of this notification:* |
|---|---|---|
| | | |

☐ I notified _____ at the RFC
Yes, write their name here.